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TID-7677
Health and Safety
(TID-4500(23rd Ed.))

AEC
AIR CLEANING CONFERENCE

Held at
Oak Ridge National Laboratory

Oct. 22-25, 1963

Sponsored
by

Harvard Air Cleaning Laboratory, Harvard University

Oak Ridge National Laboratory, Oak Ridge, Tennessee

Division of Reactor Development, U S Atomic Energy Commission

EDITED

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Prepared Under Contract AT (30-1) 1477
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USAEC Air Cleaning Conferences preceding this compilation may be identified as follows:

Air Cleaning Seminar, Ames Laboratory, September 15-17, 1952.
USAEC Report WASH-149 (OTS: \$37.80(ph); \$11.10(mf)).

Third AEC Air Cleaning Conference, Los Alamos Scientific Laboratory, September 21-23, 1953. USAEC Report WASH-170(Del) (OTS: \$59.40(ph); \$11.10(mf)).

Fourth AEC Air Cleaning Conference, Argonne National Laboratory, November 1955. USAEC Reports TID-7513, Part 1 (OTS: \$1.50); TID-7513, Part 2 (OTS: \$4.80(ph); \$2.70(mf)).

Fifth AEC Air Cleaning Conference, Harvard Air Cleaning Laboratory, June 24-27, 1957. USAEC Report TID-7551, (OTS: \$12.00(fs); \$5.09(mf)).

Sixth AEC Air Cleaning Conference, Idaho Operations Office, July 7-9, 1959. USAEC Report TID-7593, (OTS: \$4.00).

Seventh AEC Air Cleaning Conference, Brookhaven National Laboratory, October 10-12, 1961. USAEC Report TID-7627 (OTS: \$6.25).

PREFACE

As the nuclear power industry continues to grow and develop, certain limiting aspects of this development are integrally related to improved air and gas cleaning technology. In assessing engineered safeguards for reactor siting and confinement or containment, the degree of reliability which can be placed on gaseous and particulate clean-up systems is of prime importance. This area along with increased emphasis on fission product release and behavior highlighted the holding of the Eighth Air Cleaning Conference at the Oak Ridge National Laboratory from October 22-25, 1963.

The largest meeting of this series, which dates back to June, 1951, numbered approximately 225, including representatives from Canada, France, and the United Kingdom. The program was developed as a joint effort between the Harvard Air Cleaning Laboratory and the Environmental and Sanitary Engineering Branch of the Division of Reactor Development.

While the first two days of the conference were devoted to formalized papers, the entire third day was taken up by four, informal panel discussions. The importance of meteorology to air and gas cleaning operations was emphasized in one afternoon session.

A special note of thanks is extended to the many Oak Ridge National Laboratory and Atomic Energy Commission-Oak Ridge Operations Office personnel who made this meeting a success. The required last minute change in meeting room location and the several guided tours to K-25 and ORNL were handled in a most efficient and congenial manner. It was a pleasure holding this conference at Oak Ridge.



Walter G. Belter, Chief
Environmental & Sanitary Engineering Branch,
Division of Reactor Development

ACKNOWLEDGEMENT

The 8th AEC Air Cleaning Conference was a joint effort on the part of the following organizations; the individuals named planned and coordinated the program:

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OPENING SESSION

22 October 1963

INTRODUCTORY REMARKS

D. C. COSTELLO
U. S. Atomic Energy Commission
Washington, D. C.

I will call the meeting to order, now, if you please.

For all of you who have not attended the last few Conferences, I am Dave Costello from the Environmental and Sanitary Engineering Branch of the Division of Reactor Development, Headquarters, AEC.

First I would just like to mention a change that has come up. At zero hour we were required to change our Conference location. There was nothing we could do about it. You probably have heard about the strike that is going on now at Oak Ridge.

The Management of the Operations Office obtained this alternate location and we certainly do appreciate it. Everything is going to work out all right.

There have been some inconveniences but hope you will bear with us. It is just one of those things that happened almost over night.

I want to welcome all of you here this morning, and would list a few of the representatives. We have groups from AEC Headquarters in Washington; our AEC Operations Office; Oak Ridge National Laboratory; contractors -- that is, the AEC contractors -- other Government agencies; universities, and private industry.

I would like to extend a special welcome to our foreign visitors. We have representatives from Canada, the United Kingdom and France; we just received a wire that our representatives from West Germany will not come, unfortunately.

As far as the program is concerned, we have 31 papers, and there are a few changes on the Agenda that are very minor. We will make corrections as we go along.

There has been a tremendous increase in interest in this field. I believe the Oak Ridge papers alone could have run this Conference for us, so you can see how the thing has expanded to this stage of the game.

I would like to say we will try to hold strictly to the time schedule. We have a heavy program, and we are going to give a five-minute bell warning. We would like each paper to end on time, about 15 minutes each, and leave a few minutes for pressing questions. If some speaker wants the audience to break in and ask questions, it's up to you to raise your hand and be recognized. Give your name and affiliation.

We are, of course, very sorry we could not accommodate all submitted papers. We had over two times the number we actually could accommodate. We certainly want to thank all you for preparing them. They will go in the Conference Proceedings.

As far as announcements are concerned, tomorrow morning we would like to start at 8:30 A.M. We will stick to the schedule as far as today is concerned, but tomorrow morning we would like to start the meeting at 8:30 A.M. That would mean we would break for lunch at quarter of 12:00 Noon for roughly a half hour sooner than we had originally planned.

Before finishing I would like to thank those who have greatly assisted us here: Sam Shoup; Ray Herwin and secretaries; Frank Bruce; Don Cowen; Steve Sinichak; Bob Schneider; Walt Stockdale from the Oak Ridge National Laboratory; and, John Arendt from the K-25 group. Many others that assisted us in setting up this program, and we certainly appreciate their effort.

I would next like to have the pleasure of introducing our first speaker this morning. He is a man well known in the Atomic Energy Field. He has held top management positions in this program since 1946. He has been in this present position since 1951. It gives me great pleasure to introduce to you this morning the Manager of the Oak Ridge Operations of the Atomic Energy Commission at Oak Ridge. Mr. S. R. Sapirie.

S. R. SAPIRIE

Manager

Oak Ridge Operations

Gentlemen, it is a real pleasure for me to be able to welcome you to Oak Ridge on behalf of Oak Ridge Operations of the Atomic Energy Commission. The Oak Ridge National Laboratory, your host, and the Division of Reactor Development, the sponsor for this meeting, have developed an extremely interesting and full agenda for your meeting, so my remarks will be extremely brief.

I understand that this is the first Conference of this type to be held in Oak Ridge, although before the numbered Conferences were scheduled, there were several meetings of the Stack Gas Working Group, and I think the meeting immediately preceding the first Conference was held in Oak Ridge, but since this is the first numbered Conference held here, there may be a number of you that have not visited Oak Ridge before. Particularly for those who have not been here before, I am sure that you will find a visit to the Oak Ridge National Laboratory, and the adjacent community here, to be both interesting and enjoyable.

This Conference, as I understand it, will have an attendance of between 200 and 250. This is almost twice the number of 125 that attended the last Conference at Brookhaven, two years ago. I think this alone indicates the increase in interest in the air-cleaning problems.

The problems are extremely important to the Atomic Energy Commission, but the Commission alone is not unique in recognizing air-cleaning problems. All of industry has similar problems. So I am sure that there will be a lot of technological spin-off from your meeting, and from the related research that is being recorded here that will be of interest to industry as a whole. This fact is also reflected by the increase in number of articles and various technical journals on your problems, and the increase in attention being given to air-cleaning problems by the popular press.

I am sure that your meeting here will be extremely productive. I hope it is also enjoyable. If there is anything that our staff can do to help you, do not hesitate to call upon us. Thank you.

D. C. COSTELLO
U. S. Atomic Energy Commission
Washington, D. C.

Thank you very much, Mr. Sapirie.

Next I have the pleasure of introducing my own supervisor, Mr. Walter Belter, of the Environmental and Sanitary Engineering Branch. This Branch is under the Director of Nuclear Safety of the Division of Reactor Development.

Mr. Belter plans to give us some more details on the Conference here this morning. It is a pleasure for me to introduce Mr. Walter Belter.

W. G. BELTER
U. S. Atomic Energy Commission
Washington, D. C.

Thank you Mr. Costello. Also, thank you, Mr. Sapirie, for the most cordial welcome to the Oak Ridge National Laboratory. We are really pleased to be able to hold the Eighth Air Cleaning Conference at the Lab.

As many of you know, the Division of Reactor Development has been sponsoring and organizing air-cleaning conferences for approximately the past 12 years, with the first meeting having been held at Harvard University in June of 1951.

In developing a program for a meeting of this type, one will look back at the Proceedings of the previous meetings to see what the problems were five, six, or seven years ago. Who were some of the people who were involved in those meetings at that time? How, possibly, do the problems in air and gas cleaning compare with the operations and activities of those days? It is interesting to note the number of familiar faces who attend these conferences time after time in addition to the many newcomers that we see each year. As Les Silverman has remarked from time to time, we always have approximately 50% newcomers for each meeting.

As Mr. Sapirie indicated, the attendance at these conferences get larger and larger each time, which tends to make the development of a program somewhat more difficult.

If you recall the last Conference at Brookhaven two years ago, we had a total of something like 37 formal papers presented in about 2 1/2-day period. We could have used easily another half-day for questions and further discussions.

This year we are going to try a somewhat different approach. We are planning only a two-day session, with formal papers, with ample time for discussion after each of these sessions. On Thursday, we are then planning to hold four round-table panel discussions, which are going to be highly informal, and which should provide ample time and opportunity for active discussion and participation by everyone in the audience.

In looking at our program agenda for the next two days, one cannot but help notice the tremendous difference in the program content when compared with the Conference that we held six years ago at Harvard. This, you will recall, was the last time that we held a laboratory training session, which was conducted for two days prior to the formal meeting by Dr. Silverman and his Harvard Air Cleaning Laboratory staff.

The formal meeting itself, you recall, was primarily a review and summarizing of air-cleaning operating activities at the various AEC sites, with the exception of the last day which was essentially devoted to the laboratory research work at Harvard.

During the past six years the Power Reactor Development program has really come to the fore: the problems of reactor siting; the location of power reactors near large cities; problems of reactor confinement or containment; fission product release in case of a reactor incident; the types of gaseous and particulate clean-up systems which can be used; how effective are they for radio-iodine removal under various conditions of pressures, temperatures, steam, et cetera; what type of meteorologic control is required for routine or accidental releases of gaseous effluents. These are only a few of the questions which are related to air and gas cleaning, and which are plaguing many of the people in the reactor development program at the present time.

Other reactor development programs such as the SNAP and ROVER programs, have associated air-cleaning problems, and also meteorological problems which are of interest and possible concern.

High temperature filters which will function satisfactorily above 1,000°F may be required in the not too distant future for applications at test stands for nuclear rockets, and ram jet engines.

In terms of some other problems, we still have the potential noble gas-release problem associated with chemical reprocessing, and, of course, the rare gas problem associated with reactor operation. As you perhaps know, the first commercial chemical reprocessing plant is now under construction in the State of New York. With future high burn-up fuels, the release of Krypton-85 could possibly be controlling, and might affect the future operations of this plant. The release of noble gases could also be the controlling factor in the building of large power reactors in populated areas, as well as being the most restrictive factor in bringing some of our nuclear-powered ships into populated ports. We believe that much work still remains to be done in developing larger scale noble gas-removal equipment.

In looking at the program for this morning I note that one of the problem areas mentioned, that is, the quantifying, or description of fission products release or behavior under certain operating or accident conditions, is the subject of actually the first several papers.

Another interesting session tomorrow morning is the confinement and containment approaches, which are being investigated.

We are quite pleased to welcome several of our meteorologist friends, who will participate in this meeting. The session on Wednesday afternoon, on the meteorological aspects of air cleaning, shows the increased emphasis that we are placing on this part of the gaseous effluent problem.

We are always glad to have our counterparts from foreign countries, such as the United Kingdom, France and Canada join with us in any of our waste-management meetings.

For those of you from foreign countries who are not already on the program, we have allotted some time at the end of Wednesday afternoon in order that we may have the opportunity to hear some of your experiences, and also the results of your research and development activities in the air-cleaning field.

It is again a pleasure to have Dr. Morgan and Mr. Jamison and Mr. Kornegay from our Johns Hopkins Contract, who will be responsible for our recording and handling the Proceedings of this Conference.

We would like to think that the information which is presented at the Air Cleaning Conferences, and published in the Proceedings, is being widely used in the design and operation of the AEC contractor and licensee air and gas-cleaning systems. We are quite hopeful that we will be able to publish this report quicker than any of the others to date.

We sponsored an air-cleaning laboratory training session at Harvard in June 1957. We might be thinking about this in the next several days so that at the end of the meeting we could decide whether it would be desirable to repeat this training type of session in conjunction, possibly, with the next air-cleaning conference. The holding of any session of this type obviously depends on your general interests and requirements.

We are again pleased that many of you could turn out for this meeting, and I am particularly pleased at this meeting room facility. Certainly, from the standpoint of transportation, being close to our living facilities here, and the meeting room itself, I am sure we could not have done as well in the 4500 Building.

So, we are hoping that the presentations and informal discussions which will follow will be of interest, and certainly useful to you in your work.

As we glance at this morning's session, it is my pleasure to introduce to you your morning Session Chairman, Mr. Frank Bruce, of the Oak Ridge National Laboratory. I am sure that many of you know him from his association with the Nuclear Safety Research and Development work which is being conducted here at Oak Ridge National Laboratory, and for which he has direct responsibility.

Also, Mr. Bruce is responsible for all of the Safety activities within the ORNL operations. Prior to that he was very much involved in the Chemical Technology Division at the Laboratory, in the chemical reprocessing work, and also was responsible for much of our waste treatment research development work here. Right now he is responsible for the Nuclear Safety work, which includes much of the fission product release work being conducted for the Commission. There are several papers on that subject in this session.

It is with great deal of pleasure that I introduce to you now Frank Bruce of the Oak Ridge National Laboratory.

F. R. BRUCE

Assistant Deputy Director
Oak Ridge National Laboratory

Thank you, Mr. Belter. The safety and operating of the reactors in populated areas is a matter of primary importance to the nuclear-energy industry today. In addressing himself to this question, Dr. Beck of the Division of Licensing and Regulations recently expressed cautious optimism concerning the location of reactors near populated areas.

In support of his position he referenced two facts: first, the recent accumulation of knowledge on the release and behavior of accident-released fission products; and, secondly, developments in engineered safeguards, such as water sprays, filters, foam encapsulation, and other techniques, which may be used to remove fission product aerosols from containment vessel atmospheres.

It is, therefore, very appropriate, I think, that the first session of this Conference concern itself with the matter of fission product release and behavior, and with methods for removing the hazard controlling radio-isotope Iodine-131 from gaseous effluents.

In later sessions of the Conference there will be further discussions of containment, and engineered safeguards.

SESSION I - PARTICLE AND GAS RELEASES AND THEIR BEHAVIOR

Morning - 22 October 1963

F. R. Bruce, ORNL, Chairman

The first paper of Session I is entitled, "Release of Fission Products on In-Pile Melting or Burning of Reactor Fuels," the authors being C. E. Miller, W. E. Browning, Jr., B. F. Roberts, and R. P. Shields, of the Oak Ridge National Laboratory. The paper will be given by R. P. Shields.